

# Plasmon assisted Cooper pair formation at room temperature

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Electron pair formation is the basis of low temperature superconductivity. Such pair formation phenomenon has been theoretically forecasted also for electron-electron scattering processes in strong electromagnetic fields. In the present work the strong electromagnetic fields were created by femtosecond Ti:Sa lasers, used to excite surface plasmons in gold films at room temperature in the Kretschmann geometry. Studies were conducted using a surface plasmon near field scanning tunneling microscope, measuring it's response to the excitation at plasmonic hot spots on the gold surface, and an electron time-of-flight spectrometer, measuring the spectra of multi-plasmon emitted electrons as the function of exciting laser intensity. Narrow periodic „resonances” have been found in the time-of-flight spectra of electrons, with anomalies in the laser intensity range, where electron pairing has been found, since in this laser intensity range, some of the also periodic in time, but less frequent narrow peaks have been detected. They are about twice as intense as the remaining ones, indicating the simultaneous detection of two electrons. These electrons could be emitted only from Cooper pairs, since in our and other's understanding this observation can not be interpreted in any other way [1,2]. In this laser intensity range the Meissner-effect has also been observed. Detailed analysis of both the STM and TOF findings are presented.

[1] P. Racz, N. Kroo: *Physics of Wave Phenomena* 27(3), pp. 1-5 (2019)

[2] K.A. Kouzakov, J. Berakdar: *PRL* 91, 257007 (2003)